

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:  
Hiroyoshi KATO et al.

Application No.: 10/575,756

Confirmation No.: 6847

Filed: April 13, 2006

Art Unit: 1793

For: CEMENT SETTING ACCELERATOR

Examiner: A. J. Green

DECLARATION UNDER 37 C.F.R. § 1.132

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

I, Hiroyoshi KATO, do declare and say as follows:

1. I am a co-inventor of above-identified application.
2. My *curriculum vitae* is attached.
3. I have read the Office Action dated June 5, 2009 in the above-identified application and understand its contents.
4. I have read and understand the contents of the reference cited in the June 5, 2009 Office Action, which is Japanese Patent Specification No. JP-A 2003-277111A (hereinafter referred to as "JP '111").

5. In the June 5, 2009 Office Action, the Examiner refers Applicants to various parts of JP '111, including paragraphs [0004] and [0006]. In particular, the Examiner states that it is believed that the surface area (Blaine specific surface area) of calcium hydroxide as disclosed in JP '111 corresponds to the particle size as claimed. I submit the following explanation to refute this position, which includes a table and graphs discussing the relationship between particle diameter and Blaine value (specific surface area).

6. Calcium hydroxide particles used in the present invention have an average particle diameter of 2.5  $\mu\text{m}$  or less. This average particle diameter would be equivalent to a Blaine specific surface area of about 40,000  $\text{cm}^2/\text{g}$  or more. The cited JP '111 reference fails to disclose such calcium hydroxide fine particles, and fails to disclose or suggest that the calcium hydroxide fine particles show a great agglomeration promoting effect by themselves. JP '111 may disclose a lower limit for slaked lime powder of 3,000  $\text{cm}^2/\text{g}$ , but clearly never contemplates amounts of 40,000  $\text{cm}^2/\text{g}$  or more either alone or combination with other cement ingredients.

**Concretion Promoting Effect of Finely Ground Slaked Lime**

With a small average particle diameter being 2.5  $\mu\text{m}$  or less, the present invention unexpectedly achieves a reduction in the degree of supersaturation of calcium hydroxide that is in the cement paste liquid phase and also accelerates the hydration reaction of the cement.

(i) **Hydration promoting mechanism of cement by finely ground slaked lime**

It is known that when the hydration reaction of cement proceeds, the degree of supersaturation of calcium hydroxide contained in a liquid phase of a cement paste lowers.

The present inventors discovered that when fine calcium hydroxide having an average particle diameter of 2.5  $\mu\text{m}$  or less is added to cement, this promotes a reduction in the degree of supersaturation of calcium hydroxide contained in the cement paste liquid phase and also accelerates the hydration reaction of the cement. It is assumed that this effect is caused by the function of the added fine calcium hydroxide as crystal nuclei for the precipitation of calcium hydroxide. The concretion promoting effect of the present invention is obtained based on this finding which is not attained or taught in the cited JP '111 reference. Therefore, it is impossible to estimate this effect from the JP '111 disclosure which lacks any description of a particle diameter of calcium hydroxide.

(ii) Blaine specific surface area and concretion promoting effect

Table 2 below shows Examples 16 and Comparative Examples 11 and 12, which are added to Examples 13 and 15 and Comparative Examples 9 and 10, of Table 9 of the present application. Since it is difficult to measure the Blaine value of fine calcium hydroxide having an average particle diameter of 2.5  $\mu\text{m}$  or less, the Blaine values of Examples 13, 15 and 16 were estimated by the approximation of measurement values shown in Fig. 1 (also below).

It is understood from Fig. 2 that the concretion promoting effect of the present invention is obtained when the average particle diameter is 2.5  $\mu\text{m}$  or less. At the same time, the concretion promoting effect of the present invention is not obtained when the average particle diameter is larger than 2.5  $\mu\text{m}$ . Such results are unexpected.

Fig. 3 shows the relationship by the Blaine value (estimated value in a very small range). It is understood from Fig. 3 that the effect of the present invention is obtained when the specific surface area is much smaller than those shown in the cited JP '111 reference. In addition, this

effect is obtained by adding only slaked lime, and it is impossible to anticipate this effect from the disclosure in JP '111, wherein the use of slaked lime in combination with another compound is essential in the reference.

**Table 1: Addition of Comparative Example 11 to Table 9**

	Average particle diameter (µm)	Specific surface area (cm <sup>2</sup> /g)	Compressive strength (N/mm <sup>2</sup> )	
			Material age	
			1 day	7 days
Ex. 13	0.45	57000	42.9	71.9
Ex. 15	1.6	45200	41.0	70.2
Ex. 16	2.3	40550	39.0	69.0
C. Ex. 9	-	-	26.8	60.7
C. Ex. 10	12.0	6650	29.3	62.4
C. Ex. 11	7.3	15780	29.9	63.4
C. Ex. 12	5.2	26700	30.4	64.1

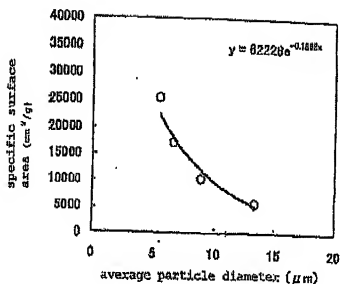


Fig. 1: Relationship between average particle diameter and  
Blaine specific surface area of slaked lime

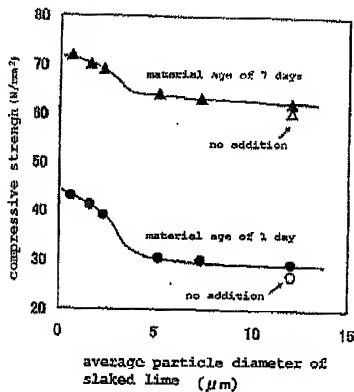


Fig. 2: Average particle diameter and compressive strength slaked lime

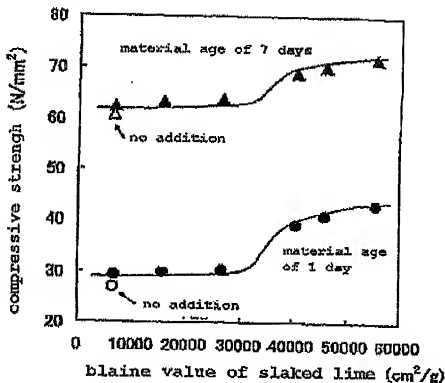


Fig. 3: Blaine value and compressive strength of slaked lime

(iii) The Present Invention compared to JP '111

The subject matter of the JP '111 reference is an effect obtained by using a combination of another compound and slaked lime and differs from the subject matter of the present invention in basic idea. But note the relationship between the Blaine value and compressive strength of slaked lime in Fig. 4 below (Experiment Nos. 1-1, 1-18, and 2-14 to 2-16).

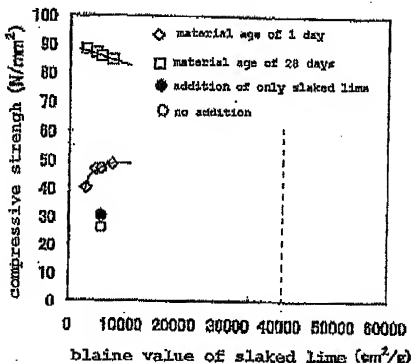


Fig. 4: Data of JP '111

As can be seen, Fig. 4 shows a different range as compared with those ranges shown in Fig. 2 or Fig. 3. Put differently, it is obvious that the effect obtained from an increase in Blaine value tends to hit a ceiling or even drop. It can be said from this data that the effects of the present invention cannot be anticipated based on the cited JP '111 disclosure. The disclosure of the Blaine specific surface area of calcium hydroxide in JP '111 does not correspond to particle size.

Also, in JP '111, Experiment Nos. 1-1 and 1-12 of Example 1 show a case where no curing accelerator is used and a case where only slaked lime (A-3, Blaine specific surface area of 6090 cm<sup>2</sup>/g) is used as a curing accelerator, respectively (wherein both are Comparative



Examples). It is understood from the evaluation of mortar compressive strength ( $\text{N/mm}^2$ ) that the curing acceleration effect of slaked lime is slightly observed when the material age is 1 day. However, the existence of slaked lime retards curing when the material age is 28 days.

That is, it cannot be said that slaked lime having a Blaine specific surface area of  $6,090 \text{ cm}^2/\text{g}$  shows a curing accelerating effect by itself. The cited JP '111 reference discloses that a cement curing promotion effect is obtained by using a combination of slaked lime having the above Blaine specific surface area and a thiosulfate or the like as obvious from other experiments of its Example 1 and fails to disclose that the effects of the present invention are obtained by using slaked lime only.

Thus, the surface area (Blaine specific surface area) of calcium hydroxide as disclosed in JP '111 does not correspond to the particle size as claimed. Also, by adding fine calcium hydroxide having an average particle diameter of  $2.5 \mu\text{m}$  or less to cement, this unexpectedly promotes a reduction in the degree of supersaturation of calcium hydroxide contained in the cement paste liquid phase and also accelerates the hydration reaction of the cement.

7. I hereby declare that all statements made herein of my own knowledge are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: September 3, 2009

By: Hiroyoshi Kato  
Hiroyoshi KATO

Attachment: *Curriculum vitae*

(Attachment)

Curriculum vitae of Hiroyoshi Kato

I, Hiroyoshi Kato, graduated from the Faculty of Engineering of Kyoto University in March 1990, entered Tokuyama Soda Kabushiki Kaisha in April 1990, assigned to the Cement Construction Material Technical Center, finished a doctor's latter-term course in the graduate school of Kyoto University in September 2002 during that time, and engaged in the research and development of cement and concrete.